# FINAL REPORT

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## Quantifying Phosphorus Reductions for Proposed Projects in NY Reduction Plan


**CONTACT INFORMATION**

Lake Champlain Lake George Regional Planning Board
1 Lower Amherst Street, PO Box 765, Lake George, NY 12845
518-668-5773 Allison.Gaddy@lclgrpb.org



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## EXECUTIVE SUMMARY

Nutrient loading is a major concern to the water quality in the Lake Champlain watershed. Excess nutrients can cause a severe decline in water quality by creating an environment that is beneficial to invasive species, harmful algae blooms, and other water quality damaging effects. A number of best management practices (BMPs) including stormwater retrofits, green stormwater infrastructure, and streambank stabilization are among the main tools that we have in combating nutrient loading. This project, Quantifying Phosphorus Reductions for Proposed Projects in NY calculated potential pollutant reductions for proposed water quality improvement projects throughout the Lake Champlain Basin in order to measure success and help to prioritized local efforts and funding for future project implementation.

This project was born out of a need to assist local and regional resource managers to identify targeted projects for nutrient reductions. This is a continuation of ongoing efforts within the watershed, complementing the completion in 2018 of the Lake Champlain Non-Point Source Pollution Subwatershed Assessment and Management Plan, which identified specific implementation projects and needs to address water quality concerns. A total of 263 projects were identified in the plan, 130 of which were used in this project to quantify their phosphorus, nitrogen, and sediment reduction potentials. Calculations were completed using the NYSDEC Pollutant Load Reduction Calculator. Data needed for the calculator was collected and analyzed by Warren County GIS and verified by LCLGRPB staff though on the ground field work. BMPs for each project were assigned from the 25 predefined categories available and based on the project description provided in the *Subwatershed Assessment and Management Plan*.

The results of the calculations are provided in Lake Champlain Pollution Reduction Dashboard, an online mapping tool to be used by resource managers throughout the watershed to quantifying pollutant load reductions resulting from the implementation of BMPs in the Lake Champlain basin. This information will be used to assist with funding requests and in prioritizing future actions.

Following the completion of the pollutant reduction calculations, one project was chosen for implementation based on estimated pollutant reduction results. The ditch stabilization and hydroseeding project was completed by Essex County Soil and Water Conservation District and the Town of Westport Department of Public Works. The estimated pollutant load reductions from this project into Lake Champlain are 64.54 lbs/year of phosphorus, 69.15 lbs/year of nitrogen, and 228,658 lbs/year of sediment.

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## 1. PROJECT SYNOPSIS

The *Lake Champlain Non-Point Source Pollution Subwatershed Assessment and Management Plan* (2018) identifies nearly 300 specific planning and implementation projects to reduce the phosphorus inputs into surface waterbodies from various nonpoint sources. While the implementation of each of these projects will result in a water quality benefit to the Lake Champlain basin, calculating each project's potential pollutant load reduction is needed to quantify these benefits and to further prioritize high impact projects for implementation.

The calculation of the estimated phosphorus and nitrogen reductions was completed using the New York State Department of Environmental Conservation's Pollutant Load Reduction Calculator. The calculator, designed by the New York State Department of Environmental Conservation (NYSDEC), uses a formula based off the *Simple Method to Calculate Urban Stormwater Loads*. The load formula includes annual rainfall, percent impervious surface, pollutant event concentration, and area land use as determined in ArcGIS using the National Land Cover Data Set:

$$L = P \times Pj \times Rv \times C \times A \times 0.226$$

Where:

- P is annual rainfall in inches (assumed to be 42 inches)
- Pj is the % annual rainfall producing runoff (default is 90%)
- Rv is the runoff coefficient = 1.05+0.009I (I is the percent impervious surface 0 – 100%)
- C is the pollutant concentration (mg/l)
- A is the area of a particular land use (acres) – A is assumed to equal one acre of land
- 0.226 is a unit conversion factor

Projects were chosen from the Subwatershed Assessment based on their best fit for the calculator's capabilities. Pollutant load reduction calculations were performed for 130 projects from throughout the Lake Champlain basin.

To delineate the geographical areas impacted by each project, LCLGRPB worked with the Warren County Planning Department who utilized Geospatial Information Services (GIS) to determine the drainage areas and other necessary metrics for the proposed project. The best-fit land use classification for each project was also selected during this process. Additionally, BMPs from the predetermined categories of the calculator were assigned to each project based on the project description provided in the Subwatershed Assessment. Potential BMP categories include:

- Bioretention/Raingarden
- Bioswale
- Conversion of Impervious Surface
- Ditch/Channel Stabilization
- Dry Ponds
- Infiltration Trench
- Permeable Pavement w/Sand, Veg. - A/B soils, no underdrain
- Permeable Pavement w/Sand, Veg. - A/B soils, underdrain
- Permeable Pavement w/Sand, Veg. - C/D soils, underdrain
- Permeable Pavement w/o Sand, Veg. - A/B soils, no underdrain
- Permeable Pavement w/o Sand, Veg. - A/B soils, underdrain
- Permeable Pavement w/o Sand, Veg. - C/D soils, underdrain

- Vegetated Swale
- Septic Connection
- Wetland Restoration
- Hydroseeding
- Stormwater Treatment Controls
- Riparian Forest Buffer
- Septic Pumping
- Streambank Stabilization
- Drywell Installation
- Rooftop Runoff Disconnection
- Wet Ponds
- Road Stabilization
- Stormwater Runoff Reduction Controls

The output of the calculator provides the estimated reduction of phosphorus, nitrogen, and sediment in pounds per acre per year for each of the projects that were analyzed.

To keep partner organizations aware of this project, regular updates were given at the regular meetings of the county's Water Quality Coordinating Committees (WQCCs) throughout the watershed and the Champlain Watershed Improvement Coalition of New York (CWICNY) meetings. The online mapper which visualizes the locations of project sites and allows for the viewing of the reduction numbers is hosted on the LCLGRPB website (https://www.lclgrpb.org/lake-champlain-basin-pollution-reduction) and was promoted to the general public through postings on LCLGRPB's social media and in LCLGRPB's annual and quarterly reports.

In addition to the online mapper, LCLGRPB staff were able to identify a low cost, high impact project for implementation in the Town of Westport, Essex County, NY on Decker Road. The project BMP was Ditch/Channel Stabilization, with a project area of 922 linear feet. The resulting calculation of this project's potential pollutant load reduction was found to be the removal of 64.54 lbs/year of phosphorus, 69.15 lbs/year of nitrogen, and 228,658 lbs/year of sediment. LCLGRPB partnered with the Town of Westport and the Essex County Soil and Water Conservation District to complete the implementation of this project in the Spring of 2023.

## 2. Tasks Completed

**Task 1. Develop a QAPP –** The LCLGRPB and Warren County GIS completed the QAPP for all the data required in Tasks 2-11.

**Task 2-6. Identify project drainage areas and land use acreages for 20% of projects –** Warren County GIS used StreamStats and ArcGIS to determine the drainage areas and land use types for all projects based on project locations provided by the Subwatershed Assessment.

**Task 7-11. Input Parameters into DEC Calculator for selected projects –** LCLGRPB staff determined each project's BMP and input the GIS data previously collected in the calculator.

**Task 12. Create webpage and outreach –** The final project webpage is housed on the LCLGRPB website which includes the background and goals of the project, as well as an online mapper, which allows for an interactive visualization of the project locations throughout the watershed. The mapper was created by Warren County GIS staff and is housed through the Warren County ArcGIS account and server.

**Task 13. Implement project –** LCLGRPB staff worked to determine a priority project for implementation by quantifying potential nutrient reduction loads, potential project cost, and feasibility for implementation. A final project decision was made to implement a ditch

stabilization project in the Town of Westport in partnership with the Essex County Soil and Water Conservation District staff. The project consisted of removing sediment from the ditch, reinstallation of check dams, lining the ditch with gravel to reduce future erosion, and hydroseeding select areas.

**Task 14-19. Submit Quarterly and Final Reports -** Reports were completed on a quarterly basis throughout the project and this final report was completed at the culmination of the project.

## 3. METHODOLOGY

**Task 2-6. Identify project drainage areas and land use for selected projects –** Using ArcGIS and the USGS Streamstats application(https://streamstats.usgs.gov/ss/), the Warren County GIS Department utilized the most recent GIS and LiDAR data to determine the drainage areas for each project using the following steps:

1. Locate project location from latitude/longitude coordinates provided in the Subwatershed Assessment.

2. Drainage area for the selected project/BMP location will be generated using StreamStats tools.

3. Export drainage area to a Shapefile.

4. Using ArcGIS, the Shapefile will be imported and overlayed with 2-foot Contour Data and/or LiDAR data (when available and appropriate) in order to visually compare the StreamStats generated drainage area with the drainage area delineated by contour lines. A. It is accepted general knowledge that a drainage area is delineated by identifying the highpoints in the topography along the subject watercourse with the direction of flow always being perpendicular to the contour lines. By connecting the highpoints in the contour data in this fashion, the drainage area is identified and can be compared for consistency with the drainage area delineated by StreamStats. B. To be considered consistent, the Streamstats data should be within 5% of the contour/DEM data. If the StreamStats drainage area is determined to be inconsistent with the drainage area identified with the contour data, the area identified using contour/DEM data will be utilized for the remainder of the analysis.

5. Once the drainage area for each project/BMP is confirmed, the drainage area shapefile will be overlaid with the most recent 2016 National Land Cover Database (NLCD) which will be converted from raster to polygons using ArcGIS.

6. The Land Use/Land Cover data will be clipped to the drainage area for each project using the Clip too in ArcGIS. Quantifying Phosphorus Reductions for Proposed Projects in NY Reduction Plan

7. Total acreage of each land use/land classification type within each project/BMP drainage area will be calculated using ArcGIS Calculate Tools.

8. The total acreage of each land use type for each drainage area will be determined using the Summarize Tool in ArcGIS.

**Task 7-11. Input Parameters into DEC Calculator for selected projects –** Data gathered from tasks 2-6, project drainage area and land use were entered into the Pollutant Load Reduction Calculator. Each project was assigned a BMP based off descriptions provided in the Subwatershed Assessment and the calculator's predefined BMPs. Baseline pollutant loads for each BMP are already programed within the calculator. Final outputs of phosphorus, nitrogen, and sediment reductions were calculated and recorded for 130 projects.

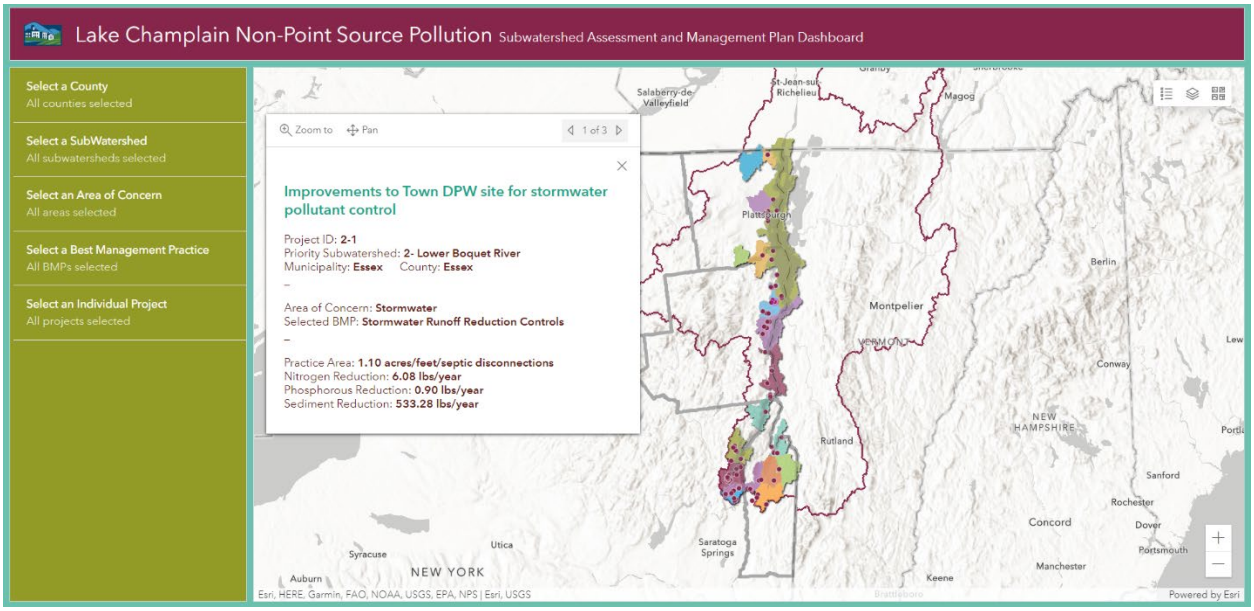
## 4. Quality Assurance Tasks Completed

A QAPP was performed for Task 2 through Task 11. Task 2-6, Identify project drainage areas and land use acreages for 130 projects: Project were chosen based on their compatibility with the NYSDEC Pollutant Reduction Calculator. The chosen projects were non-agriculture and non-point source projects and included roadside and streambank stabilization projects and green infrastructure projects. Project locations were provided by the Subwatershed Assessment while the drainage area was generated using StreamStats tools and exported into ArcGIS. Land use was determined by using the most recent National Land Cover Database.

Task 7-11. Input Parameters into DEC Calculator. After the drainage basins and landcover was determined, LCLGRPB staff entered the data into the calculator. Within the Calculator, baseline pollutant loads have already been calculated and programed, the selected BMP utilizes both the drainage basin acreage and the landcover type to produce the final reduction total.

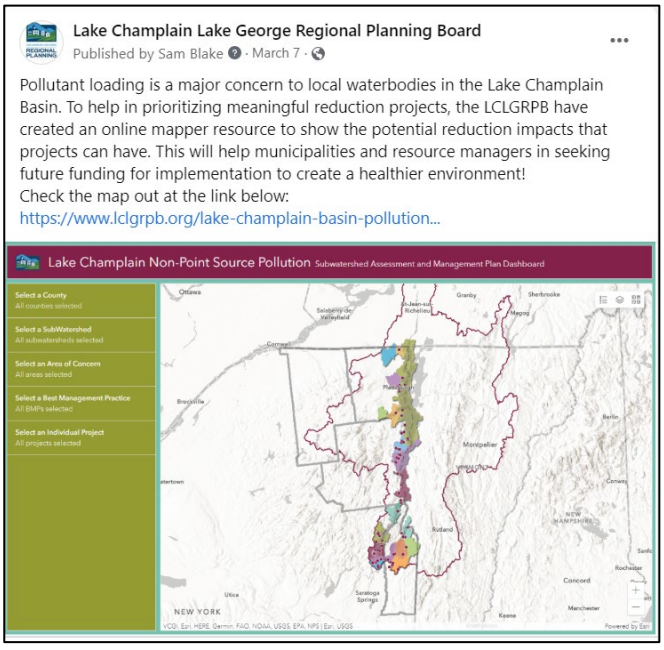
## 5. DELIVERABLES COMPLETED

Deliverables completed throughout this project include the calculation of potential pollutant reduction numbers for 130 projects, the creation of an online mapper and outreach materials, and the implementation of one high impact pollutant load reduction project.




Lake Champlain Basin Pollution Reduction Mapper – available on the LCLGRPB website at https://www.lclgrpb.org/lake-champlain-basin-pollution-reduction

The mapper, which shows the pollutant reduction calculations for 130 projects is available on the LCLGRPB website and housed through the Warren County Planning Department's ArcGIS account and servers. The mapper is intended to assist resource managers throughout the New York side of the Lake Champlain basin in prioritizing high impact projects, the implementation of which will contribute to overall water quality improvements in Lake Champlain. The map allows users to locate projects freely by scrolling around the watershed, or by filtering various attributes including County, Subwatershed, Area of Concern, BMP, or each individual project. Outreach was conducted in promoting the mapper and its usefulness to those working within the watershed. Outreach consisted of discussions at monthly CWICNY meetings and social media posts through LCLGRPB Facebook and LinkedIn pages, gaining a total of 449 impressions and 4 shares to other pages. The mapper was completed on schedule and released in the Winter of 2023.




LCLGRPB Facebook Post. March 7, 2023.

A ditch stabilization was implemented in the Town of Westport along the town owned Decker Road. In partnership with Essex County Soil and Water Conservation District staff , the Westport Department of Public Works staff worked to remove accumulated sediment from the ditch which was allowing for flow to bypass the check dams, installation of new check dams, lining the ditch with gravel to reduce future erosion, and hydroseeding select areas. In total, the pollutant reduction calculation of the project will result in the removal of 64.54 lbs/year of phosphorus, 69.15 lbs/year of nitrogen, and 228,658 lbs/year of sediment.

Decker Road before (left) and after implementation project (right).

## 6. Conclusions

Project accomplishments included the calculations of potential pollutant reductions of 130 projects listed within the *Lake Champlain Non-Point Source Pollution Subwatershed Assessment and Management Plan,* the creation of an online mapping resource and the associated outreach efforts in promoting the tool, and the implementation of a high impact pollutant reduction project in the Town of Westport, NY.

This project helped support both NEIWPCC's Water Program Priorities under the *Watershed Planning and Waterbody Protection* category, and the Lake Champlain Basin Program's 2017 *Opportunities for Action* achieving Task I.A.1.C c – Increase understanding of factors affecting BMP performance and efficiency by utilizing a NYS DEC derived tool to quantify estimated phosphorus and nitrogen reductions associated with BMPs that have been identified by New York resource managers. It also helps in achieving Action Task I.A.2.c – Assess progress of existing water quality management programs by helping to inform how BMPs are working by attaching estimated phosphorus reduction numbers to implementation projects.

At the conclusion of this project the LCLGRPB continues to work with partners to identify the many projects that have already been completed without LCLGRPB involvement by Soil and Water Conservation Districts, individual municipalities, and watershed non-profit organizations. We not only will be able to create a comprehensive list of completed projects throughout the watershed, but we will be able to calculate the full impact of many hours and money spent

working to better improve water quality for the enjoyment and safety of New Yorkers who use Lake Champlain and its waterbodies throughout the watershed.

## 7. REFERENCES

New York State Department of Conservation. *Pollutant Load Reduction Calculator.* *https://www.dec.ny.gov/docs/water_pdf/bmpcalcguide.pdf*

Lake Champlain Lake George Regional Planning Board. (2018). *Lake Champlain Non-Point Source Pollution Subwatershed Assessment and Management Plan.* *https://documentcloud.adobe.com/link/track?uri=urn:aaid:scds:US:5395420a-c462-4ac2-bc0e-853016294fcb*